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AUTHOR Mayer, Richard E.
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ABSTRACT

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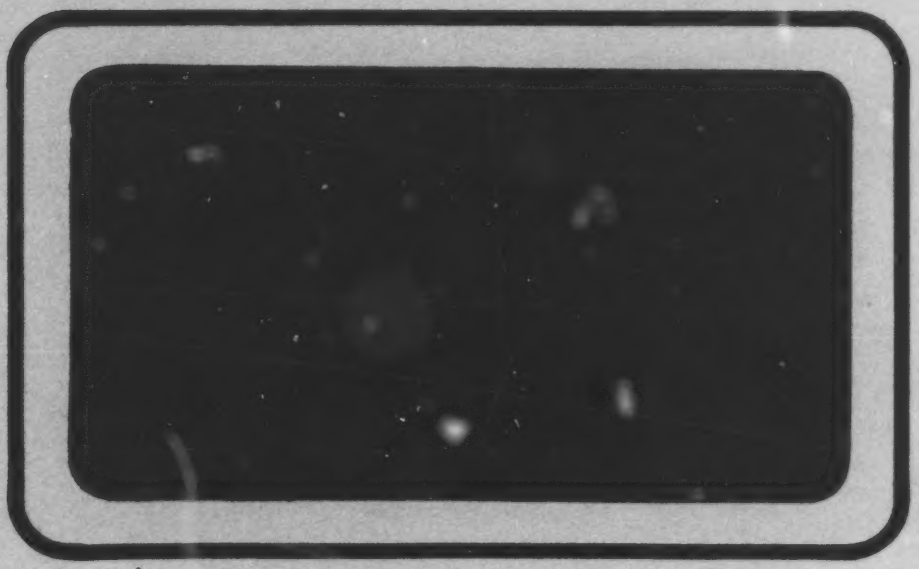

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Department of Psychology
University of California
Santa Barbara, California 93106

SERIES IN LEARNING AND COGNITION

Twenty Years of Research on Advance Organizers

Richard E. Mayer

Report No. 79-1

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Abstract

Fourty-four published research studies involving advance organizers were reviewed. Twenty-seven studies included an advance organizer vs. a control group (standard advance organizer study) and 17 studies included an advance organizer vs. a post-organizer group (modified advance organizer study). Results of the studies were compared to the predictions of several theories. In addition, four specific predictions of assimilation theory were evaluated: that advance organizers should have a stronger effect for poorly organized text than well organized text, that advance organizers should have a stronger positive effect for learners lacking pre-requisite knowledge, that advance organizers should have a stronger effect for learners lacking pre-requisite abilities, and that advance organizers should have an especially strong effect on measures of transfer rather than retention.

Introduction

In 1960, Ausubel reported a study in which 120 college students read a 2500 word text on metallurgy after reading either a 500-word expository organizer that presented the underlying concepts for the information or a control 500-word historical passage. The advance organizer group (AO) performed slightly and significantly better than the control (C) on a posttest (AO = 47% correct, C = 40% correct).

Ausubel (1960, p. 271) noted that this study investigated the hypothesis that "learning and retention of unfamiliar but meaningful verbal material could be facilitated by advance introduction of relevant subsuming concepts." The advance organizer contained "substantive background material of a conceptual nature presented at a much higher level of generality, abstraction, and inclusiveness" than the text and which "was empirically shown to contain no information that could be directly helpful in answering test items." The obtained effect was attributed to (1) "the selective mobilization of the most relevant existing concepts in the learner's cognitive structure for integrative use "in subsuming the new material, and (2) the "optimal anchorage for the learning material" within the rich assimilative context.

Ausubel's subsumption theory has been presented more fully elsewhere (Ausubel, 1964, 1968, 1977) and Mayer (1975a) has offered a similar theory to explain the results of a series of studies on meaningful learning of problem solving. For the purposes of the present paper, the term "assimilation theory" will refer to the idea that learning involves relating new, potentially meaningful material to an assimilative context of existing knowledge. Thus the conditions of meaningful, assimilative learning are:

Reception -- The new material must be received by the learner.

Availability -- The learner must possess, prior to learning, a meaningful assimilative context for integrating the new material.

Activation -- The learner must actively use this context during learning to integrate the new information with old.

The function of the advance organizer concerns the second and third conditions -- namely to make an assimilative context available and to encourage the learner to use it during learning.

Assimilation theory predicts that advance organizers will have a positive effect on learning only when the two functions of organizers -- to make available and activate meaningful learning sets -- would not normally occur. According to assimilation theory, the following conditions must be met, if advance organizers are to have an effect:

(1) Material. The material must be unfamiliar to the learner. In terms of assimilation theory, this means that the material should not contain or elicit any general subsuming context from the learner.

(2) Material. The material must be potentially meaningful or conceptual. This means that it should be possible that an assimilative context (or set of concepts) could exist for helping the learner organize and comprehend the material.

(3) Advance Organizer. The advance organizer must provide or locate the meaningful context.

(4) Advance Organizer. The advance organizer must encourage the learner to use that context during learning.

(5) Learner. The learner does not possess relevant conceptual context for the material, and does not normally try to relate new information to his/her existing conceptual frameworks.

(6) Test. The test should measure the breadth of learning. Assimilation theory predicts that the AO subjects should integrate new information with old and thus acquire broader outcomes. Performance measures should measure this by using transfer and long term retention, rather than only verbatim retention.

According to assimilation theory the following situations should fail to produce effects for advance organizers:

Situation A. The material that is used presents or tends to elicit a meaningful context for learning. An example would be a spiral text that used many familiar examples or provided remediation when learners lacked pre-requisite concepts.

Situation B. The material that is used is mainly a collection of unsystematic facts that have no unifying organization. An example would be a text listing the characteristics of imaginary countries or a list of historical facts.

Situation C. The advance organizer does not provide information that is relevant for understanding the material. An example would be an advance organizer that simply summarizes the to-be-learned material or which lists the key terms.

Situation D. The advance organizer does not encourage the learner to integrate the information even though an assimilative context may be available. An example would be an advance organizer that presents

a model that learners fail to perceive as being related to the to-be-learned material.

Situation E. The learner already has much pre-requisite experience and normally learns by relating this conceptual experience with new incoming information. An example would be that advance organizers such as concrete models are not needed to teach professionals who have already developed their own "models."

Situation F. The test measures only simple, verbatim retention. Such a test may fail to assess the breadth of learning.

There are several issues raised by assimilation theory. One concerns the locus of the effect of advance organizers: assimilation encoding theory states that organizers influence the encoding of new material while assimilation retrieval theory states that organizers are a retrieval aid. A second issue concerns the nature of assimilation: strict assimilation theory states that the new material becomes integrated with existing knowledge to produce a qualitatively new learning outcome while a more lenient version of assimilation theory (called "addition theory" in an earlier paper by Mayer, 1975) states that advance organizers simply allow the learner to add more information to memory by virtue of having more anchors or hooks. This review will investigate the results bearing on these two issues whenever it is available. (Unless otherwise stated, assimilation theory will refer to the strict version of assimilation theory and the encoding rather than retrieval theory.)

There are, of course, alternatives to assimilation theory. The most straightforward alternative is "reception theory," namely the idea that amount learned is a function only of how much was presented and received by

the learner. The "availability" or "activation" of assimilative sets need not be considered according to this view. This theory predicts that advance organizers should have no effect on posttest measures of learning as long as the test does not measure any information from the advance organizer, and all subjects are presented with the same target information.

Recent Reviews

Since 1960, there have been hundreds of studies of the effects of advance organizers, and dozens of reviews. After twenty years, it may now be possible to revisit this work in order to determine whether or not research on advance organizers provides support for assimilation theory.

One reason for the importance of this issue is that assimilation theory is one of the main pillars of the modern psychology of learning and memory. Assimilation theory is generally taken for granted and it seems that one cannot read a textbook on learning and memory without finding a statement to the effect that learning involves connecting new ideas with old knowledge. Certainly this is not a new idea: similar quotes could be taken from the philosopher Herbert writing in the 1800's or from the forerunner of cognitive psychology, Bartlett (1932). However, advance organizer studies provide one clear battleground for testing assimilation theory -- one with important theoretical and pedagogic implications.

One particularly distressing problem is that some of the more recent reviews of studies since Ausubel's early work have suggested that support for advance organizers is in doubt; hence, a major pillar holding assimilation theory is in doubt. For example, Barnes & Clawson (1975) provide one of the most negative reviews. After considering 32 selected advance organizer studies

they concluded: "Advance organizers, as presently constructed, do not facilitate learning." (p. 651) This review was undertaken in order to determine whether the findings of advance organizer studies were consistent with assimilation theory. Since there are many cases in which assimilation theory predicts there should be no effects for advance organizers, it seems that it is possible that reviews such as Barnes & Clawson could find many negative studies but that assimilation theory could still be consistent with the results. In order to investigate this idea, a review must carefully note the details of each study in order to determine whether all conditions stated above have been met.

Much of the apparent conflict in results obtained in advance organizer studies can be accounted for by noting whether any of these conditions occurred. It is likely that many of the reported "failures" to obtain effects due to advance organizers may be attributed to one of these five situations. Similarly, it can be noted that most "successful" studies tend to overcome each of these five problems. For example, most advance organizer studies use mathematical or scientific material because such material is often unfamiliar (Condition A) and has a rich conceptual basis (Condition B).

Unfortunately, it is often not possible to tell whether these five conditions have been met based on the written reports of researchers. Often, the reports do not clearly specify what the materials, the advance organizer, the subjects, and the test were like. However, in the review that follows every effort was made to fairly assess these five situations based on what the authors have provided.

Scope of This Review

This review was conducted in order to extensively examine the research concerning advance organizers that has been generated since 1960. In particular, this review was conducted to determine the extent of support for assimilation theory as cited earlier, by carefully examining the results of research on advance organizers.

The goal of the literature search was to provide a data base that was as extensive as possible and one that was readily available to any interested reader. The search attempted to locate all advance organizer studies published since 1960. In order to achieve this goal, the following methods were used. First, a computerized data retrieval search was conducted using the ERIC database; the search located all papers in the data base which contained the word "advance organizer" (or "advanced organizer") in the title, abstract or as a descriptor. Second, the relevant bibliographic portions of several recent reviews on advance organizers were included (Ausubel, 1962, 1968, 1977; Barnes & Clawson, 1975; Barron, 1972; Blanton, 1972; Hansell, 1976; Hartley & Davies, 1976; Koran, Baker & Strickland, 1975; Lawton & Wanska, 1977; Lesh, 1976a; Mayer, 1977a; Novak, Ring & Tamir, 1971; Ring & Novak, 1971; Vacca, 1977). In addition, for each paper located in steps 1 and 2, its reference list was examined for citations of additional advance organizer studies. Finally, manual searches were conducted and each journal that had published at least one advance organizer was scanned for additional studies.

The criteria for accepting a paper as a research paper on advance organizers were as follows. (1) The paper was published in a journal or book. (Technical reports, unpublished convention addresses, and theses were not

included.) (2) The study contained (at least) an advance organizer group and a control group; such studies were termed "standard advance organizer studies" even if other, additional treatment groups were included. Or, the study contained (at least) an advance organizer group and a post organizer group; such studies were termed "modified advance organizer studies" even if other, additional treatment groups were included.

This procedure generated 50 papers that met the first criterion given above; of these, 6 failed to meet the second criterion. For example, papers by Pella & Triezenberg (1969), Proger et al. (1970), and by Andrews (1971; 1973) were not included because there was no control group in any of these studies. Each study compared one type of advance organizer against one or more other types of advance organizer (such as verbal vs. verbal plus picture). In the study by Dyer (1971), the main independent variable seemed to be the amount of detail in pictures which accompany text rather than a comparison on AO and C groups. Finally, the AO and C groups used by Allen (1970) included other manipulations such as adjunct questions, and thus there was no "pure" group that received only the AO or only the PO. Thus while each of these six studies provides potentially useful information concerning advance organizers, they were not included in this analysis because they failed to meet the second criterion of being standard advance organizer studies.

Thus there were 44 papers that met the above criteria; of these 8 papers failed to report group means but did provide a verbal description of the data. These studies were included but their usefulness was obviously limited. No papers were eliminated on the grounds that the advance organizer used was not in accordance with Ausubel's (1968) definition.

This review did not include studies which used titles as an advance organizer (Bransford & Johnson, 1972; Dooling & Lachman, 1971; Dooling & Mullet, 1973; Pichert & Anderson, 1977; Schallert, 1976; Kozminsky, 1977) or studies which used topic sentences as advance organizers (Gagne, 1969; Gagne & Wiegand, 1970; Rickards, 1976; Rickards & McCormick, 1977; Cunningham, Pastore & Mizokawa, 1974; Christie & Schumacher, 1976). Both the to-be-learned material and the "advance organizer" are much shorter in these studies than in standard or modified advance organizer studies. This review also did not include studies of the effects of behavioral objectives or studies of the effects of providing pre-questions. Although each of these types of studies is related to advance organizers, they constitute separate research and theoretical questions.

The data base for this review is the 44 papers which used a standard or modified advance organizer design and which were published. This data base is considerably larger than any existing review's data base meeting these same criteria, and this data base is more homogeneous with respect to experimental methods than other existing reviews. All 44 papers were located in the libraries of the University of California, Santa Barbara or UCLA. It should be noted that the topic of "advance organizers" seems to be a fairly well defined one. Many of the papers cited a common core of earlier papers, especially those by Ausubel. While the papers differed in purpose and style, they all are directly relevant to the present review and allow 44 independent tests.

Standard Advance Organizer Studies

In a standard advance organizer study there are at least two treatment groups, one group receives an advance organizer prior to instruction (AO) while the other group receives either a control passage or nothing (C). Then both groups read a target text, view a video-tape, or engage in some other instructional activity. Finally a test or series of dependent measures are administered. There were 27 papers that reported studies fitting this description.

The reception theory predicts that the test scores of the AO and C groups should be indistinguishable if the test covers just the material in the target learning task (and nothing from the AO). This prediction is based on the premise that learning is based simply on what is presented and received by the learner. Since the learner is exposed to the same target material in both treatments, posttest scores should be equivalent.

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Insert Table 1 about here

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The assimilation theory predicts that the scores of the AO group should be higher than for the C group, under certain circumstances. This prediction is based on the idea that learning involves integrating new information with existing knowledge; thus a broader, more integrated outcome is possible if a learner has relevant anchoring ideas for assimilating the new material and if a learner actively uses these ideas for integrating the incoming information. Since the outcome of learning depends both on what is presented and the assimilative context to which it is integrated, AOs may result in broader learning outcomes.

It should be noted assimilation theory predicts that AOs should have an effect mainly in situations where a learner either does not possess relevant subsumers or would not normally use them during learning. Thus, AOs should have their strongest effects: (1) for materials which are technical or unfamiliar or not well-organized, (2) for learners who have not had previous experience or ability with respect to the to-be-taught material, and (3) for test items that measure transfer to novel situations. In addition, AOs will have an effect only when the AO actually presents a useful assimilative context for the general ideas in the to-be-learned material.

Table 1 summarizes the results of the 27 standard advance organizer studies in the data base. Each report is identified by the author's name, year of publication, and the number of subjects. Then three pieces of information are given:

(1) Is the material unfamiliar, technical, and lacking a basic assimilative context? A brief description of the to-be-learned material is given.

(2) Is the advance organizer likely to serve as an assimilative context? A brief description of the organizer and control is given.

(3) Does the AO group perform better than the C group on a test? Typical test scores are given for both groups; these are converted to percentage correct when it is possible to do so. Also, when many experiments were conducted or several retention tests were given, generally the data from the largest study and the immediate test are shown in the table.

Unfortunately, in many cases the studies involved more than just two groups and separate statistics were not performed. However, based on the analyses which were performed and on the raw data, the 27 studies were divided into three groups: 10 studies in which the AO group performed better than the C group; 13 studies in which the AO group performed better than the C group, especially under certain predicted conditions (such as especially for low ability subjects, for subjects low in prerequisite experience, for poorly organized text, or for transfer tests); and four studies in which the AO group did not outperform the C group. It should be noted that almost all of the studies used materials from mathematics or science or related areas which had some well defined general framework.

Since the vast majority of studies found evidence for the AO group outperforming the C group, at least under predicted situations, special attention should be paid to the four published studies that clearly failed to find an effect for advance organizers. The study by Kahle & Nordland (1975) failed to report means or standard deviations for the two treatment groups so that it is really not possible to determine whether the raw scores of the AO group were higher than for the C group. However, this study used a mastery procedure in which individual remediation was administered by tutors; the effects of advance organizers would normally be washed out in this case since the remediation procedure could supply the needed pre-requisite anchors. Also, a 10-minute organizer was used for a four week course thus minimizing the effect of the organizer.

The study by Eastman (1977) produced consistent but small differences favoring the AO group; however, these differences failed to reach statistical significance. The author notes that the organizer might have been too short or

not related to the to be learned material. Similarly, the organizer used by Santiesteban & Koran (1977) may have been an overview rather than a subsumptive context. Finally, the study by Koran & Koran (1973) may have used material that consisted mainly of facts rather than a general framework.

This analysis clearly refutes the conclusion of Barnes & Clawson (1975) that there is no evidence for the effects of advance organizers. However, there are many problems with the simple "box score" presented in this section. First, many of the studies did not directly test the AO group vs. the C group since in some cases other groups were included. Second, many of the studies failed to describe the materials, organizers, and tests in sufficient detail so that it was not completely possible to determine whether they fit the criteria listed above. Third, while standard advance organizer studies provide a rough general test of assimilation theory, other more specific predictions are not tested in such studies. For example, standard advance studies fail to control for the placement of the advance organizer, and thus do not provide a test of whether organizers serve as retrieval or as encoding aids. Finally, standard organizer studies are subject to the criticism that AO subjects receive more information than C subjects; unless careful precautions are taken it may be possible that specific information in the advance organizers aid performance on posttests. In summary, this analysis suggests that there is adequate support for the statement that advance organizers result in small but consistent advantages over control treatments, especially when material is poorly organized, material is unfamiliar, and subjects are inexperienced. However, more specific, better controlled tests are needed.

Modified Advance Organizer Studies

Modified advance organizer studies allow for a more specific test concerning the locus of the advance organizer effect, and for better control of what information is presented to learners. In modified advance organizer studies, one group receives an advance organizer prior to instruction (AO) while the other group receives the same information after instruction but before the test (PO). As in standard advance organizer studies, instruction involves reading a text, viewing a video-tape or some other instructional activity, and the dependent measure is performance on a retention or transfer test.

According to the assimilation encoding theory (and the addition theory), subjects receiving the AO should perform better on a test than subjects receiving a PO. This prediction is based on the idea that organizers influence the encoding of new information rather than serve mainly as retrieval aids. The reception theory predicts that AO and PO groups should perform at equivalent levels on a posttest since both have been presented with identical information (albeit in different orderings). Modified advance organizer studies thus overcome a criticism raised in previous section since all subjects receive the same information, and these studies allow a pinpointing of the locus of the effect at encoding rather vs. retrieval.

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Insert Table 2 about here

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There were 17 modified advance organizer studies in our data base, and these are summarized in Table 2. As can be seen, there were four studies in

which the AO group outperformed the PO group; there were six studies in which the AO group performed better than the PO group especially under certain pre-specified conditions (such as only on transfer problems or only for poorly organized material); and there were seven studies finding only partial or no differences.

An analysis of the 10 cases where AO groups outperformed PO groups reveals that most used mathematical tasks that required a conceptual structure for full understanding. Information could be learned in a rote way, when no assimilative context was available to a learner during learning (such as in PO treatments), but could be integrated with an assimilative context for the AO treatments.

An interpretation of the seven negative results is also needed. First, the study by Schell (1973) failed to report means or statistical tests; since two other groups were used in addition to the AO and PO groups it is impossible to tell whether or not there was a difference between the AO and PO groups. Similarly, the study by Buyuk et al. (1970) also failed to report means for the treatment groups. In addition, the AO was a statement of eight facts from the passage and thus might not have served as a high level subsumer; in addition, there were two additional groups in the data analysis (pre-questions vs. post-questions) so it is impossible to tell whether there was a difference between the AO and PO groups. The study by Clawson & Barnes (1973) also failed to report means for the treatment groups; one problem in this study is that the unit of statistical analysis was the classroom rather than the individual student so that the n was very low. When the value of n is low it is possible to have a moderate difference in means without

obtaining a significant statistical difference. Another problem with this study is that in-class interaction during the study could have provided the needed subsuming ideas and thus washed out the effects of organizers. Graber, Means & Hohnson (1972) also failed to report means so that it is not possible to make a comparison of raw scores for the AO and PO groups. However, these authors point out that this replication of Ausubel's (1960) original study may have failed to produce significant results because Ausubel used subjects who were unfamiliar with the metallurgy text (i.e. psychology students) while Graber et al. used more experienced subjects (i.e. chemistry students). Thus, for four of the negative studies it is really not possible to tell whether there was a difference between AO and PO due to inadequate presentation of data.

Three studies did report means for the AO and PO treatment group. In the massive and well-replicated study by Peterson et al. (1973) the AO, a discussion of the Konigsberg bridge problem, may simply not have served to provide conceptual anchoring for the learning of mathematical network tracing. It seems that subjects may simply have failed to see the connection between the to-be-learned material and the AO. However, it can also be noted that in two of the three studies reported in this paper, there was a small advantage for the AO group over the PO group. Unfortunately, all the analysis included six other groups so that it is not possible to determine whether these small differences were significant. A similar problem obtained for the Bertou et al. study (1972); there was a small advantage for the AO group over the PO group but all data analysis involved 6 other related groups as well. Finally, a similar pattern was reported in the Romberg & Wilson (1973) study; the AO group performed slightly better than the PO group but a direct statistical

test was not carried out since analysis included six other related groups. Thus, for the three negative studies that reported means, there was a pattern in which the AO group performed slightly better than the PO group but a direct statistical test was not performed.

These results provide some support for the predictions of assimilation encoding theory. In the seven cases which failed to provide statistically significant support, four failed to report means for the AO and PO groups and of the three that did there was a pattern in which the AO group outperformed the PO group. Also, for many of the negative studies there were compelling reasons to suspect that the AO failed to provide an assimilative context.

Specialized Advance Organizer Studies: Materials

The previous two sections have provided some general support for assimilation theory, and for the idea that the locus of the effect is at encoding rather than retrieval. The remainder of this review will examine some of the more specific and detailed predictions of assimilation theory, namely those involving interactions.

One variable that could interact with the method of instruction (i.e. AO vs. C, or AO vs. PO) is the nature of the material. For example, the format of the material could be varied so that one version is well organized with many connections among key concepts or poorly organized with few transitions among concepts; another example is that the format could be varied so that one version of the instructional materials is in familiar form and one version is in more technical form.

The assimilation theory predicts that advance organizers should have a stronger effect for materials that are poorly organized (or in technical format)

than when the materials are well integrated (or in familiar format). The prediction is based on the idea that well integrated or familiar material may easily suggest an assimilative context for the reader--i.e. these formats may allow the learner to locate and use his or her own advance organizer--while more technical or poorly organized text may not evoke an obvious assimilative set in the learner. Thus, an external suggestion such as from an advance organizer should be most useful in the situations where the learner is least likely to have found or used relevant subsuming knowledge on his or her own. This theory predicts a Materials x Treatment Interaction (MTI) in which advance organizers have a strong positive effect for poorly organized (or unfamiliar material) but not for well integrated (or familiar) versions of the same material. This pattern of MTI is schematically shown in Figure 1.

The reception theory predicts that there should be no effect for advance organizers, and further that there should be no interactions involving the format of the materials. This prediction is based on the straightforward idea that amount learned is simply a function of the amount presented and received by the learner. The only factor that might influence amount learned is a main effect for format in which more organized or more familiar formats may produce more learning than poorly organized or unfamiliar versions of the same information. Thus reception theory predicts a pattern of performance such as schematically shown in Figure 1 in which there is no MTI.

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Insert Figure 1 about here

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There were four studies in the data base which provided tests of the Materials x Treatment Interaction predicted by assimilation theory. Each

study involved materials that were either well integrated or poorly organized.

Lesh (1976) asked 48 college students to watch a four hour video-tape unit on finite geometry with an organizer that gave concrete examples and models either before (AO) or after (PO) instruction. The instructional lesson was organized either in a rigid hierarchical order or in a spiral order that repeated key concepts and related new material to previous material. Results indicated that the AO outperformed the PO group (main effect for treatment was significant), the integrated organization of the spiral unit was better than the hierarchical unit (main effect for material format) and there was a significant MTI in which the advance organizer was particularly helpful for the less integrated organization.

In another MTI study, Schumacher, Liebert & Fass (1975) asked 140 college students to read a 600 word passage on six obscure U.S. Presidents with a 50-word advance organizer (AO) given before reading or not at all (C). The passage was organized as six separate unrelated paragraphs or as one integrated whole with transition phrases added. The results indicated that the integrated passage produced better test performance than the part passage; however, more importantly, there was also a significant pattern of Materials x Treatment Interaction in which the advance organizer increased performance for the poorly integrated passage but decreased performance for the well integrated version of the information.

A third MTI study was conducted by Mayer (1979) in which 40 college students read 26 frames on FORTRAN computer programming either after reading a 500-word organizer that provided a concrete model of the computer (AO) or no organizer (C). The frames were presented either in logical order or in

random order. The results produced a significant Materials x Treatment Interaction in which the advance organizer increased performance when materials were poorly organized but decreased performance when materials were well organized.

Finally, a study by Grotelueschen & Sjogren (1968) provides a fourth independent test of the MTI prediction. In two experiments, 72 subjects engaged in a concept learning task involving base 4, after reading a programmed sequence on the principles of number systems (AO) or a control lesson (C). The learning task involved learning to generate symbols in base four and was either logically ordered from 1 to 13 or was randomly ordered. The results indicated that the advance organizer aided transfer performance, especially if the material was not fully ordered during learning. Thus there was a pattern, consistent with prior Material x Treatment Interactions, in which advance organizers were more important in increasing performance when learning was poorly organized than when it was logically organized.

These four studies provide consistent support for a specific prediction of assimilation theory, namely that advance organizers should have a stronger effect when materials are not well integrated or not familiar than when they are well organized or familiar. In two cases, performance was actually poorer for the advance organizer group when the material was logically integrated; one possible explanation is that the advance organizer interfered with the learner's own model.

Specialized Advance Organizer Studies: Learner Characteristics

A second variable that could interact with the method of instruction (AO vs. C, or AO vs. PO) is the characteristic of the learner. For example,

the learners could vary with respect to how much previous pre-requisite experience they have had or with respect to an ability that is related to the learning task.

The assimilation theory predicts that advance organizers should have a stronger effect for subjects who lack rich previous experience (or who lack specific abilities) than for subjects who have had much prior experience (or high ability). The prediction is based on the idea that experienced (or high ability) learners may easily have and use their existing knowledge as an assimilative set during learning--i.e. such subjects already have existing anchoring ideas and have learned the strategy of using them in learning--while inexperienced (or low ability) learners may not normally try to connect new knowledge with any assimilative set. Thus, an external suggestion such as from an advance organizer should be most useful for subjects who would not normally try to integrate new incoming information on their own. This theory predicts a Knowledge x Treatment Interaction (KTI) or an Aptitude x Treatment Interaction (ATI) in which advance organizers have a strong positive effect for inexperienced (or low ability) learners but not for experienced (or high ability) learners. This pattern of KTI (or ATI) is schematically shown in Figure 2.

The reception theory predicts that there should be no effect for advance organizers, and further that there should be no interactions involving subject characteristics. This prediction is based on the idea that amount learned depends on amount presented and received by the learner. The high ability or experienced subjects might receive more information, and thus this theory could predict an overall main effect for ability or experience. The pattern of performance predicted by reception theory is shown in Figure 2.

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Insert Figure 2 about here

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Knowledge x Treatment Interaction. There were five standard advance organizer studies which included a pretest measure of the subjects' experience or knowledge about the to-be-taught material. Ausubel & Fitzgerald (1961) compared the retention scores of college students who read a passage on Buddhism after either a comparative organizer, an expository organizer, or no organizer. A pretest measured the subjects' knowledge of Christianity since such knowledge could be used as an assimilative context for unfamiliar information about a religious system. Results indicated that subjects who scored high on the knowledge of Christianity pretest tended to learn more overall from the passage on Buddhism; more importantly, there was a pattern of Knowledge x Treatment Interaction (KTI) with advance organizers greatly increasing the performance of subjects who scored below the median on the knowledge pretest but not for subjects who scored above the median on the knowledge pretest. Ausubel & Youseff (1963) replicated the finding that subjects scoring higher in the knowledge of Christianity pretest learned more from the Buddhism passage overall, but they failed to replicate the KTI obtained by Ausubel & Fitzgerald (1961). Instead, the AO group outperformed the C group for subjects who scored high, medium or low in knowledge of Christianity.

In another set of studies, Ausubel & Fitzgerald (1962) asked college students to read a passage on hormones regulating pubescence (passage 1) and later to read a related passage on pathology and treatment in pubescence (passage 2). Subjects were also given a pretest measuring general knowledge

of endocrinology since such knowledge could be related to appreciating the first passage. As in other studies, subjects who scored high in the knowledge pretest tended to learn more from the instructional text. In addition there was some evidence for a KTI: on passage 1, the organizer had its strongest effect for subjects who scored low in the knowledge pretest and for those who scored high, but decreased performance for the intermediate knowledge group. Also, on passage 2 the advance organizer was most helpful to subjects who had scored low on passage, and actually decreased performance for subjects who had scored medium or high. Although this pattern failed to reach significance it is consistent with the predicted direction.

In another study, Fitzgerald & Ausubel (1963) asked Northern high school students to read a passage concerning the Southern view of the Civil War after reading a comparative advance organizer or a control organizer. A pretest measured general knowledge about the Civil War, and this knowledge was likely to be from a Northern perspective. Subjects who scored higher on the pretest also tended to learn more from the passage; however, there was also a pattern of KTI in which the organizer aided the performance of subjects who had scored high in the pretest but not those who scored low. Apparently, the advance organizer helped these subjects change from a Northern to a Southern perspective since the knowledge they possessed might actually conflict with the passage. The KTI was not strong for an immediate test but was strong for the retention test.

The studies by Ausubel and his colleagues offer some support for assimilation theory but there are some inconsistencies as well. All studies found that

students who score high in pretests for related knowledge tend to learn more from the target passage, even when general ability or intelligence are controlled. Ring & Novak (1971) found additional support for this finding in a large scale study of college chemistry students; achievement was higher for those who had scored high in pretests of "subsuming" concepts. Unfortunately the results concerning the predicted Knowledge x Treatment Interaction (KTI) were not as clearly supported in Ausubel's studies. For the Buddhism passages, in one study there was a pattern in which AOs helped mainly for subjects who lacked knowledge about Christianity while in another there was no such interaction.

A series of studies by West & Fensham (1976) provides additional information concerning the interaction of instructional method and the learners' previous experience. High school students learned about the principles of equilibrium after presentation of an advance organizer or a control introduction. In addition, all subjects were pretested for their background knowledge in this area. Results indicated that subjects scoring higher on the pretest tended to learn more; more importantly there was a pattern of KTI in two separate studies in which advance organizers tended to significantly increase performance for subjects who scored low on the pretest for background knowledge but not for those who scored high. As predicted the differences between AO and C groups were washed out in third study that provided remedial pretraining of prior knowledge. These studies provide strong support for the idea that advance organizers mainly aid students who lack adequate existing knowledge.

Ability x Treatment Interaction. Another subject characteristic that has been included in several studies is the subjects' general ability to learn,

to read, etc. In these studies, a standard or modified advance organizer paradigm is used as described in previous sections; in addition, subjects are given a pretest which measures their ability on some scale such as verbal ability.

It should be noted that measures of the subjects' past experience and knowledge are directly related to the assimilation, since subjects who possess rich assimilative sets are more likely to naturally use them during learning and thus not require advance organizers. However, the role of ability is another issue that can be separated from the role of subjects' past experience. It seems possible that some measures of ability may also tap the extent to which a subject tends to use an assimilative strategy during learning; for example, if assimilative strategies are techniques for increasing the efficiency of learning and if tests of ability measure the subjects' efficiency of learning, then such tests may indicate the presence or absence of the assimilative strategy.

According to this view, assimilation theory predicts that advance organizers should have stronger effects for low ability subjects than for high ability subjects when there is an interaction involving ability. This prediction is based on the idea that low ability learners may be less likely to try to find and use an assimilative context during learning and thus will be most served by an explicit direction to do so. The pattern of Ability x Treatment Interaction predicted by assimilation theory is schematically shown in Figure 2.

Reception theory predicts no such interaction since the same information is presented to all subjects. Since high ability subjects may be able to receive

information faster or more completely, the only prediction is that high ability subjects should perform better on a posttest than low ability subjects. This prediction of no Ability x Treatment Interaction is shown in Table 2.

Several studies investigated the effects of AOs for readers with high vs. low verbal ability or reading level. For example, in the experiments by Ausubel & Youseff (1963) and by Ausubel & Fitzgerald (1962) there was a stronger effect for the AO treatment preceding text for subjects who scored low in verbal ability than for those who scored high. Proger et al. (1973) also reported that an advance organizer for a passage about scientific inventions was more benificial for subjects who scored low in verbal ability than for those who scored high. Similarly, Smith & Reese (1969) found that an advance organizer for a text given to high school students helped poor readers but not good readers. Thus in each study involving verbal or reading ability, there was a pattern in which AOs were more important for low ability subjects.

In another study, Mayer (1975) found that subjects who scored low in Mathematics SAT were helped by an advance for a text on computer programming while those scoring high were not. Koran & Koran (1973) found that errors during learning were positively related to IQ for subjects given an advance organizer but negatively related for those in the control group. These results support the idea that AOs are particularly important for low ability subjects and may actually harm the learning of high ability subjects since they already have their own method of locating and activating assimilative sets.

These studies provide modest support for the prediction of an ATI by assimilation theory. However, it must be noted that many studies may use a measure of ability yet few report the ATI data from the study. Those that do

report ATI results tend to support the directional predictions but more careful, apriori predictions are needed. The preferred variable for studying the predictions of assimilation theory is existing knowledge rather than a measure of general ability. Measures of general ability are useful only to the extent that they suggest the presence or absence of an assimilative encoding strategy--i.e. if a case can be made that high ability subjects are more likely to use an integrative learning strategy than low ability subjects.

Specialized Advance Organizer Studies: Multileveled Posttest

Most of the advance organizer studies in the literature used a single measure of posttest performance such as an achievement test given after learning. However, more detailed predictions can be made when a multileveled posttest is used, such as a posttest that includes many types of questions ranging from simple retention to far transfer. Thus one variable that could interact with the method of instruction is the type of posttest. Varying the breadth of items in the posttest provides a means of testing the strict and lenient versions of assimilation theory.

The strict version of assimilation theory predicts that advance organizers should have a stronger effect for tests of far transfer than for tests of near transfer or retention. The prediction is based on the idea that advance organizers encourage a more integrated, broader learning outcome. Such an outcome should serve best to support transfer to new situations but may have lost some of the original details of the material in the integration process. This theory predicts a Treatment x Posttest Interaction (TPI) in which advance organizers have a strong positive effect for far transfer tests but not for simple retention of details. This pattern of TPI is shown schematically in Figure 3.

The lenient version of assimilation theory (i.e. addition theory) predicts that organizers should have a strong positive effect on all relevant measures of performance. The prediction is based on the idea that advance organizers allow quantitatively more information to be added to memory. Since the learner has more information overall, then performance should be better on all types of posttest problems. This theory predicts that the AO group should outperform the C or PO group, but there should be no TPI. This pattern is given schematically in Figure 3.

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Insert Figure 3 about here

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The reception theory predicts that there should be no effect for advance organizers, and certainly no interactions involving organizers and type of posttest. This prediction is based on the idea that amount learned depends on amount presented to and received by the learner. Although performance may be higher on some types of questions (such as near transfer rather than far transfer) the two treatment groups should perform at the same level. Thus the predictions of reception theory include that there should be no TPI, and this is shown in Figure 3.

There were 10 studies in the data base which used multi-leveled transfer prettests. Several studies were conducted using a text for a simple computer programming language. In the first study (Mayer, 1975), subjects read a text that explained programming and started with a concrete model of the computer (AO) or read a text that never mentioned a model (C). All subjects took a multi-leveled transfer test consisting of six types of items; for example, near

transfer items included writing a simple linear program while far transfer included interpreting what a long looping program would do. Results indicated a pattern of Treatment x Posttest Interaction in which AO subjects performed better on far transfer test items but C subjects performed better on near transfer items. This pattern was obtained in a series of studies.

One problem with the foregoing design is that the AO group may have used the additional information in the AO to perform well on the transfer problems. In order to control the amount of information presented, a second series of studies (Mayer, 1976) was conducted using a modified advance organizer design with the same materials. As predicted, there was a pattern of TPI in which the AO group excelled on far transfer questions while the PO group excelled on near transfer.

In order to provide more precise information on exactly "what is learned" by subjects in the AO and PO treatments, a further study was conducted (Mayer & Bromage, in prep.). The design was the same as the above study, except that the test asked for the learner to write down all he or she could recall about a portion of the text "as if you were trying to explain it to a new learner." The recall protocols were analyzed for which idea units were recalled, for intrusions from other sections of the text, and for new comments added by the learner. The types of information in the recall protocols was different for the AO and PO groups: the AO subjects tended to recall more idea units having to do with conceptual aspects of the computer while PO subjects were characterized by recalling idea units having to do with technical or formal properties of programming. Also, AO subjects produced more intrusions concerning the

model of the computer discussed in the AO while the PO subjects were characterized by adding vague summary statements and intrusions that were not relevant. This different pattern in the types of information recalled produced a significant Treatment x Posttest Interaction. This pattern complements the previous findings: AO subjects recalled more conceptual information such as would be useful on far transfer problems while PO subjects recalled more specific, technical information that would be useful on near transfer.

Another question is whether the same pattern of TPI would be obtained using other materials and other instructional procedures. Mayer, Stiehl & Greeno (1975, Experiment 4) asked college students to learn to solve binomial probability problems using a guided discovery programmed procedure. One of the treatment groups read a short text prior to learning which explained the general concepts that underlie binomial probability such as the concept of trials, outcomes, etc., (AO group) while another group was given no pre-training (C group). All subjects learned to criterion and took the same multileveled transfer posttest. As in the previous studies, there was a pattern of Treatment x Posttest Interaction in which the AO group excelled on far transfer such as story problems or problems involving just parts of the formula while the C group excelled on near transfer such as problems which gave values to plug into the formula or which required using the entire formula.

In another study (Mayer, 1977) subjects learned to "count" a series of letters that were based on base 3, such as w, d, r, dw, dd, dr, rw, rd, rr, dww, and so on. Subjects learned by anticipation method and all subjects continued until they reached a criterion of two errorless trials. Half the subjects (AO group) were told prior to learning that w = 0, d = 1 and r = 2 while the other half were given the same information after learning (PO group).

On a posttest that was given to all subjects, the AO and PO group both performed at a high level on recall of the learned sequence but the AO group excelled on transfer such as extending the sequence beyond what was learned or performing addition using letters. Thus a similar pattern of TPI was obtained in present study using arithmetic as was found in previous studies using statistics and computer programming as the to-be-learned materials.

Several studies also investigated the effects of advance organizers on how subjects learn and use premises for reasoning tasks. For example, Mayer (1976) asked college students to memorize nine connections among pairs of letters such as H to L, M to N, C to M, M to H, etc. Half the subjects (AO group) were told prior to learning that the letters represented names of U.S. cities such as H for Houston, M for Miami, N for New York, C for Chicago, L for Los Angeles, etc.; half of the subjects received the same information after learning (PO group). A posttest, given to all subjects, asked questions such as: "How many legs are there to get from N to L?" Each question required that the learner remember 1, 2, 3, 4 or 5 of the learned pairs and that they be put together in order. The results indicated that for problems requiring no inferences or just one inference, the AO and PO groups performed at similar levels; however, for longer problems which required putting many premises together into a long chain of inference, the AO group was much faster than the PO group. This pattern of TPI indicated that the AO group stored the premises in a more integrated fashion while the PO group may have tended to store each premise as a separate isolated unit.

A similar study by Mayer (1979) was performed in which subjects learned premises in a linear ordering task. The terms were presented as letters such

as S > B, J > S, etc. Half of the subjects were told prior to learning that the letters stood for boys' names such as S for Sam or B for Bob and that one boy was always "taller than" another (AO group); the other subjects were given the same information after learning (PO group). On a posttest given to all subjects, the PO group produced approximately the same number of errors for each question type while the AO group produced an entirely different pattern. This TPI reached significant and suggested that the two groups stored the premises differently.

There have also been a number of studies which used multileveled posttests but failed to produce Treatment x Posttest Interaction. Grotelueschen & Sjogren (1968) used both a measure of learning and a measure of transfer in evaluating what subjects had learned in a concept learning task. In general, however, the AO group outperformed the C group on both measures. Also, studies by Scandura (1966a, 1966b) involved routine and novel test items for a concept learning task. However, the AO group tended to outperform the C group for both types of problems. It must be noted that none of these studies was specifically designed to investigate Treatment x Posttest Interaction (TPI) so that the tests used may not have been sensitive to differences in what is learned by different groups.

In summary, there is consistent evidence that advance organizers may have a particularly strong effect on far transfer or conceptual posttest questions. The predicted pattern of TPI was consistently obtained when a multi-leveled posttest having many types of questions was used. Thus there is some support for the strict version of assimilation theory.

Conclusions and Recommendations

Twenty years of research on advance organizers have produced a mass of data, and many conflicting claims. However, a careful analysis of the specific qualifications and the specific predictions of assimilation theory suggests that assimilation theory is well supported by the results of advance organizer studies. Contrary to earlier conclusions based on more limited data bases, this review allows the following conclusion: Twenty years of research on advance organizers has clearly shown that advance organizers can affect learning, and the conditions under which organizers are most likely to affect learning can be specified.

Thus it is now possible to suggest conditions for the use of advance organizers. As a general rule, advance organizers will result in broader learning outcomes in situations where the learner does not normally possess or use an assimilative context for incorporating the new material. In particular, advance organizers will result in broader learning when the material is potentially conceptual but appears unorganized or unfamiliar to the learner, when the learner lacks a rich set of related knowledge or abilities, when the organizer provides a higher level context for learning, and when the test measures the breadth of transfer ability.

The results of this review may be summarized as follows:

(1) When a standard advance organizer paradigm is used there was usually a small but consistent advantage for the AO group over the C group. This advantage is less likely when the materials are familiar, when the learners are experienced, when the advance organizer does not provide an assimilative context for the material, or when the test fails to measure transfer. These

findings support assimilation theory rather than reception theory.

(2) When a modified advance organizer paradigm is used there was some evidence that the AO group outperformed the PO group. This difference is not likely under any of the conditions listed above. These results also support assimilation over reception theory; in addition, these results support the idea that the locus of the effect is at encoding rather than retrieval.

(3) When the design of a study allowed for a Materials x Treatment Interaction (MTI) there was a consistent pattern in which advance organizers more strongly aided performance when material was poorly integrated than when it was in spiral or organized format. Thus, a specific prediction of assimilation theory is upheld.

(4) When the design of a study allowed for a Knowledge x Treatment Interaction (KTI) there was some support for the finding that advance organizers more strongly aided inexperienced learners than those possessing a rich set of subsuming knowledge. Again, a specific prediction of assimilation theory is upheld.

(5) When the design allowed for an Ability x Treatment Interaction (ATI) there were some cases where ability had no interactive effects and some in which organizers tended to aid low ability better than high ability learners. These results, while partially consistent with assimilation theory, do not provide as strong a test as the KTI results.

(6) When the design allowed for a Treatment x Posttest Interaction (TPI) there was clear evidence that advance organizers aid far transfer more than

specific retention of details. These results clearly support the strong version of assimilation theory.

Unfortunately, it is still not possible to offer a fool-proof definition of what constitutes an advance organizer. A good advance organizer provides an organized conceptual framework that is meaningful to the learner, and that allows the learner to relate concepts in the instructional material to elements of the framework. In the present studies, good organizers have been concrete models or analogies or examples, sets of general higher order rules, and discussions of the main themes in familiar terms. In the present studies, poor organizers have been specific factual pre-questions, summaries, outlines, and directions to pay attention to specific key facts or terms. The development of an organizer thus depends partly on the nature of the materials, the characteristics of the learner, and the mode of delivery. The next phase of research on advance organizers should concentrate on methods of analyzing the specific information in instruction, and the specific subsuming concepts on which it is based. These methods are emerging from developments in cognitive psychology for the representation of knowledge text (e.g., Kintsch, 1974) and for knowledge about skills (e.g., Newell & Simon, 1972; Resnick, 1976). Research using the standard and modified advance organizer paradigm has taken us over a course of twenty years and has brought us to this point. Now, new methods and more specific tests are required.

Several recommendations for further research are:

(1) Reports of studies should clearly state the to-be-learned material and the advance organizer and the test in detail. If these materials are short

they may be reproduced in the text or appendix. If lengthy they should be described in detail and then made available to any interested reader by citing them in a reference note.

(2) Means, standard deviations, cell sizes, and values of statistical tests should be reported in the text.

(3) There is no need for further single studies using the standard advance organizer design. Future studies should be larger scale and directed towards a specialized question concerning assimilation theory. An AO and PO group should always be included.

(4) Future studies should compare the effects of advance organizers to post organizers for different types of materials. In particular, the organization of to-be-learned material may be varied, or the degree of conceptual basis can be varied. In such studies, assimilation theory predicts a Materials x Treatment Interaction in which advance organizers should be more useful for poorly organized material (as compared to well integrated material), for unfamiliar or technical material (as compared to a familiar version of the same information), and for material that is conceptual (as compared to a set of unsystematic facts).

(5) Future studies should compare the effects of advance organizers to post organizers for different types of learners. In particular the learners prior experience or specifically relevant skills may be varied. Assimilation theory predicts a Knowledge x Treatment Interaction in which advance organizers should be more useful for inexperienced or low ability learners (as compared to experienced or high ability).

(6) Future studies should compare the effects of advance organizers to post-organizers using tests that are more sensitive to structural differences in what is learned. In particular, tests should include many levels ranging from retention to far transfer. In such studies, assimilation theory predicts a Treatment x Posttest interaction in which advance organizers should increase performance for far transfer but not for near transfer tests.

(7) Future theories should attempt to specify exactly what are the "subsuming concepts" in the advance organizer, how they are related to the instructional information, and how the learning outcome of an advance organizer subject differs from the cognitive structure acquired by someone who learns without an advance organizer.

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Footnote

Requests for reprints should be sent to: Richard E. Mayer, Department of Psychology, University of California, Santa Barbara, CA 93106. Preparation of this report was supported by Grant SED77-19875 from the National Science Foundation and Grant NIE-78-G-0162 from the National Institute of Education.

Table 1

Results of 27 Standard Advance Organizer Studies

Positive Results

Ausubel (1960), 120 college students

1. YES. 2500 words on metallurgical properties of plain carbon steel.
2. YES. AO = 500-word expository organizer
   C = 500-word historical passage
3. YES. AO = 47%, C = 40%

Merrill & Stolurow (1966), 675 male college students

1. YES. Programmed lesson on an imaginary science.
2. YES. AO = statement of basic underlying principles
   C = none
   (There were also 4 other groups.)
3. YES. AO = 51%, C = 36%

Scandura (1966a), 80 11th graders

1. YES. Concept learning task
2. YES. AO = lesson on use of symbols and higher order rules
   C = none
3. YES. AO = 86%, C = 43% (on immediate test)

Note. Each record gives the name of the author(s), the date of publication, the subject population, (1) whether the materials are unfamiliar and potentially meaningful and a description, (2) whether the advance organizer provides and elicits use of an assimilative context and a description, and (3) whether the results were positive and the mean percent correct for the two groups on the first reported test.

Scandura & Wells (1967), 104 college students

1. YES. 1000-word passage on mathematical groups OR
   1000-word passage on topology.
2. YES. AO = "followed by" game with basic principles of groups, or
   "play like" game with basic principles of topology
   C = 1000-word historical passage on men of mathematics
3. YES. AO = 71%, C = 62%
   AO = 8.1, C = 9.2 (minutes on learning task)

Kuhn & Novak (1970), 300 college students

1. YES. Lesson on temperature control, hormones, etc.
2. YES. AO = 800 words on homeostasis
   C = 800 word historical passage
3. YES. No means given, $p < .01$

Weisberg (1970)

1. YES. 1110 words on North Atlantic Ocean Floor
2. YES. AO_1 = 500-word verbal description of ocean floor
   AO_2 = map of ocean floor
   AO_3 = diagram of ocean floor
   C = none
3. YES. AO_1-C = 11%, $p < .01$

Kuhn & Novak (1971), 300 college students

1. YES. Lesson on temperature control, hormones, etc.
2. YES. AO = 800 words plus diagram on homeostasis
   C = 800 word historical passage
3. YES. AO = 61%, C = 49% (immediate), $p < .01$

Kahle & Rastovac (1976), 116 9th & 10th graders

1. YES. Three week hierarchical audio-tutorial on genetics
2. YES. AO = taped organizer before each of 3 units
   C = historical tape before each of 3 units
3. yes. AO = 64%, C = 58%

Lawton (1977), 120 six and ten year olds

1. YES. Lesson on primitive cultures with logical relations
2. YES. AO_1 = higher order rules and examples
   C = none
   AO_2 = same as AO, plus references to AO in lesson
3. YES. AO_1 = 65% and 35%, C = 2% and 1% (for 6 year olds, exp. 1, 2 types of questions)
   AO_1 = 90% and 60%, C = 25% and 8% (for 10 year olds, exp. 1, 2 types of questions)

Jones (1977), high school science students

1. YES. Slide and tape show on "feedback"
2. YES. AO = lesson on analysis techniques and examples
   C = none
3. YES. AO = 71%, C = 62% (immediate, college prep students)
   AO = 55%, C = 49% (immediate, basic students)

<u>Positive Results Especially Under Predicted Conditions</u>

Ausubel & Fitzgerald (1961), 155 college students

1. YES. 2500 words on Buddhism's ideals
2. YES. AO_1 = 500 word comparative organizer
   AO_2 = 500 word expository organizer
   C = 500 word historical passage

3. YES.* Especially for subjects scoring low in prior knowledge about Christianity

AO_1 = 48%, AO_2 = 44%, C = 44%, (for all students, first test)

AO_1 = 45%, AO_2 = 38%, C = 36% (for low prior knowledge, first test).

Ausubel & Fitzgerald (1962), 143 college students

1. YES. Passage 1 = 1400 words on hormones regulating pubescence; passage 2 = 1600 words on pathology and treatment in pubescence
2. YES. AO = 500 word expository organizer for passage 1

   C = 500 word control passage
3. YES.* Especially for low ability subjects

   AO = 97%, C = 91% (for passage 1, all subjects)

   AO = 92%, C = 75% (for passage 1, low ability subjects)

Ausubel & Youseff (1963), 162 college students

1. YES. 2500 words on Buddhist ideas
2. YES. AO = 500 word comparative organizer

   C = 500 word historical passage
3. YES.* Especially for low ability subjects

   AO = 43%, C = 39% (for all subjects)

   AO = 41%, C = 35% (for low ability subjects)

Fitzgerald & Ausubel (1963), 264 high school students

1. YES. 2900 words on the Southern interpretation of the causes of the Civil War
2. YES. AO = 450-word comparative organizer

   C = 450-word historical passage

3. YES.* Especially for students with pro-Northern biases

AO = 54%, C = 50% (for immediate test, for pro-Northern students)

AO = 42%, C = 38% (for immediate test, for all students)

AO = 41%, C = 31% (for delayed test, for pro-Northern students)

AO = 30%, C = 26% (for delayed test, for all students)

Grotelueschen & Sjogren (1968), 72 adults

1. YES. Concept learning in base 4 number system

2. YES. AO_1 = programmed text on principles of number systems

AO_2 = programmed text on base 10

AO_3 = programmed text on base 7

C = programmed text on history of measurement

3. YES.* Especially for random learning organization

AO_1 = 9.5, C = 5.5 (number correct on posttest, random order, exp. 1)

AO_1 = 4.5, C = .5 (number correct on transfer, random order, exp. 1)

Smith & Hesse (1969), 414 11th graders

1. MAYBE. 1700-word biography titled "Our First Congresswoman"

2. MAYBE. AO = 3-minute recording on need for democracy

C = none

3. YES.* Especially for low ability readers and transfer questions

AO = 58%, C = 53% (for low ability, all questions)

AO = 82%, C = 66% (for low ability, transfer questions)

Proger et al. (1973), 112 6th graders

1. MAYBE. 1674 words words on life of Marconi and his inventions

2. MAYBE. AO_1 = 1 sentence outline

AO_2 = 1 paragraph abstract

C = none

(plus 2 other groups)

3. YES.* Especially for girls and low ability readers and anxious readers

AO_1 = 78%, AO_2 = 80%, C = 75% (for all subjects)

AO_1 = 78%, AO_2 = 75%, C = 72% (for girls)

AO_1 = 78%, AO_2 = 71%, C = 72% (for low ability)

Mayer (1975), 176 college students

1. YES. 10 page text on FORTRAN programming
2. YES. AO = diagram and description of computer as a familiar analogy, as part of text

   C = none

   (plus other treatment groups)
3. YES.* Especially for transfer problems

   AO = 45%, C = 29% (for transfer problems, exp. 1)

   AO = 43%, C - 43% (for easier problems, exp. 1)

Mayer, Stiehl, & Greeno (1975), 130 college subjects

1. YES. Discovery learning of how to compute binomial probability
2. YES. AO = 9 pages giving framework for general concepts

   C = none

   (plus 2 other groups)
3. YES.* Especially on transfer questions

   AO = 1.7, C = 4.9 (average errors in learning)

   AO = 40%, C = 33% (for transfer questions)

   AO = 40%, C =45% (for easier questions)

Schumacher, Liebert & Fass (1975), 140 college students

1. MAYBE. 600 word passage on 6 obscure U.S. Presidents
2. MAYBE. AO = 50 word outline

   C = none

3. YES.* Only for poorly integrated text

AO = 46%, C = 37% (for poorly integrated text)

AO = 48%, C = 55% (for well integrated text)

Mayer (1976), 160 college students

1. YES. 10 page text or 26 frame text on FORTRAN programming
2. YES. AO = concrete model of computer with description as a familiar analogy

C = none

3. YES.* Especially for transfer questions

AO = 41%, C = 19% (transfer questions, exp. 2)

AO - 53%, C = 42% (easier questions, exp. 2)

West & Fensham (1976), 252 12th graders

1. YES. Lessons on principles of equilibrium
2. YES. AO = 650 word expository and comparative organizer

C = 650 word control passage

3. YES.* Especially for subjects lacking prior knowledge

AO = 29%, C = 22% (for low knowledge subjects, exp. 1)

AO = 41%, C = 38% (for high knowledge subjects, exp. 1)

Mayer (1979), 40 college students

1. YES. 26 frames on FORTRAN programming
2. YES. AO = 500-word description and diagram of computer as a familiar analogy

C = none

3. YES.* Only for poorly organized text

AO = 41%, C = 31% (for poorly organized text, exp. 1)

AO = 36%, C = 44% (for logical text, exp. 1)

Negative Results

Koran & Koran (1973), 89 4th graders

1. MAYBE. Lesson defining 30 concepts about insects
2. YES. AO_1 = 500 words giving general framework and examples
   AO_2 = 500 words giving general framework without examples
   C = 500 word control passage
3. NO.* But AO may aid low ability learners
   AO_1 = 77%, AO_2 = 76%, C = 76% (for immediate test)
   AO_1 = +.17, AO_2 = -.09, C = -.10 (correlation between IQ and errors in learning)

Kahle & Nordland (1975), 293 college students

1. NO. 1 month audio-tutorial science course with mastery procedure and individual remediation
2. MAYBE. AO = 500-word tape and demonstration
   C = none
3. NO. No means given

note: 10-minute organizer for 4 week course; material & remediation provided subsumers

Santiesteban & Koran (1977), 105 10th graders

1. YES. Text on human population biology
2. MAYBE. AO = 200 word overview
   C = none
   (also 2 other groups)
3. NO. AO = 59%, C = 59%

note: AO may have been overview rather than subsumptive context

Eastman (1977), 87 10th graders

1. YES. Programmed text on quadratic inequalities in analytic or graphic format
2. YES. AO = 1 page showing relations among constants
   C = none
3. NO. AO = 50%, C = 45% (not significant; for analytic format)
   AO = 46%, C = 39% (not significant; for graphic format)

note: Although statistically unreliable, results are in the predicted direction for both formats.

Table 2

Results of 17 Modified Advance Organizer Studies

Positive Results

Scandura (1966b), 165 college students

1. YES. Lesson on concept learning task
2. YES. AO = lessons on symbol translation and rules

   PO = same

   (There were 4 AO and 4 PO groups.)
3. YES. AO = 37.5, PO = 30.9 (for routine questions)

   AO = 13.7, PO = 8.6 (for transfer questions)

Lesh (1976b), 48 college students

1. YES. 6 hour self instructional unit on finite groups
2. YES. AO_1 = examples with models

   AO_2 = counter-examples with models

   PO_1 = examples with models

   PO_2 = counter-examples with models
3. YES. AO_1 = 79.2, PO_1 = [illegible].3 (adjusted mean)

   AO_2 = 83.7, PO_2 = 76.9 (adjusted mean)

Lesh & Johnson (1976), 240 4th and 7th graders

1. YES. 30-minute self-instructional unit on motion geometry
2. YES. AO = one or several examples with or without concrete model

   PO = same

   (There were 4 AO and 4 PO groups.)
3. YES. No means given

Positive Results Especially Under Specified Conditions

Lesh (1976c), 48 college students

1. YES. Four hour unit on finite geometry
2. YES. AO = videotape giving concrete models and examples
   PO = same as AO
3. YES.* Especially for hierarchical structured unit
   AO = 78.9, PO = 70.1 (adjusted scores, hierarchical unit)
   AO = 80.3, PO = 78.5 (adjusted scores, spiral unit)

Mayer (1976a), 176 college students

1. YES. 10-page text on FORTRAN programming
2. YES. AO = concrete model and discussion of computer use familiar analogy
   PO = same
   (There were 2 AO, 2 PO and 4 other groups)
3. YES.* Especially for transfer questions
   AO = 48%, PO = 41% (for easier questions, exp. 1)
   AO = 49%, PO = 26% (for transfer question, exp. 1)

Mayer (1976b), 16 college students

1. YES. List of 9 letter-to-letter pairs
2. YES. AO = list for converting letters to names of U.S. cities and cover story concerning airline flights
   PO = same as AO
3. YES.* Especially for transfer questions
   AO = 22 seconds, PO = 23 seconds (solution time for short questions, exp. 3)
   AO = 40 seconds, PO = 68 seconds (solution time for longer inference questions, exp. 3)

Mayer (1977b), 68 college students

1. YES. Lesson on counting in base 3 using unusual symbols
2. YES. AO = list for converting symbols to digits 0, 1, or 2

   PO = same as AO
3. YES.* Especially on transfer tests

   AO = 50% and 61%, PO = 17% and 21% (on two transfer tests)

Mayer 1979a), 40 college students

1. YES. Verbal discrimination task based on six-term linear ordering using letters
2. YES. AO = list for converting letters to boys' names and cover story telling subject to think of "taller than" relation

   PO = same as AO
3. YES.* Especially on inference questions

   AO = 77%, PO = 77% (for easier questions)

   AO = 91%, PO = 78% (for inference questions)

Mayer (1979b), 96 college students

1. MAYBE. 16 sentences about 4 imaginary countries
2. MAYBE. AO = matrix showing 4 types of attributes and 4 country names

   PO = same as AO
3. YES.* Mainly for poorly organized text and low ability subjects

   AO = 75%, PO = 64% (for poor organization, low ability, exp. 2)

   AO = 68%, PO = 70% (for good organization, low ability, exp. 2)

Mayer & Bromage (1979), 108 college students

1. YES. 10 page text on FORTRAN programming
2. YES. AO = diagram and discussion of computer as a familiar analogy

   PO = same as AO

3. YES.* Only for concepts and novel ideas

AO = 3.3, PO = 4.4 (number of technical facts recalled, exp. 1)

AO = 6.1, PO = 4.9 (number of conceptual ideas recalled, exp. 1)

AO = 1.3, PO = .7 (number of appropriate intrusions, exp. 1)

AO = 3.0, PO = .4 (number of references to AO, exp. 1)

Negative Results

Buyuk, Proger & Mann (1970), 123 12th graders

1. YES. 2700 word passage on psychology of instinct and motivation
2. NO. AO_1 = statement of eight facts from passage

AO_2 = multiple choice questions covering eight facts from passage

PO_1 = same as AO_1

PO_2 = same as PO_2

3. NO. no means

(note: organizers not really subsumers)

Bertou, Clasen & Lambert (1972), 176 9th graders

1. YES. 30-minute video tape on atomic energy
2. YES. AO = 6-minute tape

PO = same

(There were also 6 other groups.)

3. PARTIAL. AO = 50%, PO = 45%

Graber, Means & Johnson (1972), 140 college chemistry students

1. YES. Ausubel's (1960) 2500 words on metallurgy
2. YES. AO = Ausubel's (1960) 500-word organizer

PO = same

(There was also a C group.)

3. NO. No means given.

(note: Author's note that Ausubel's subjects were psychology students while present subjects were chemistry students.)

Clawson & Barnes (1973), 20 3rd grade classes & 15 6th grade classes

1. MAYBE. Social studies text for 24-day period, including in-class interaction
2. MAYBE. AO = summary and discussion of key concepts for each lesson
   PO = same as AO
3. NO. No means given

   (note: Test not possible since means not reported. Classroom interaction could wash out AO effects.)

Peterson, Thomas, Lovett & Bright (1973), 248 8th graders and 259 college students

1. YES. 5 pages on network tracing
2. MAYBE. AO = discussion of Konigsberg bridge problem
   PO = same
   (There were 6 other groups.)
3. NO. AO = 51%, PO = 44% (immediate test, exp. 1)
   AO = 58%, PO = 59% (immediate test, exp. 2)
   AO = 80%, PO = 74% (immediate test, exp. 3)

Romberg & Wilson (1973), 228 11th graders

1. YES. 4 pages on mathematics of radioactive decay
2. YES. AO = 2 paragraphs about uranium, atomic fusion, etc.
   PO = same plus connectives
   (also 6 other groups)
3. PARTIAL. AO = 60%, PO = 55% (for immediate test)
   AO = 46%, PO = 42% (for retention test)

Schnell (1973), 160 college students

1. YES. 1028 word text on neural maturation
2. YES. AO = 125 words giving conceptual relationships

   PO = same

   C = none

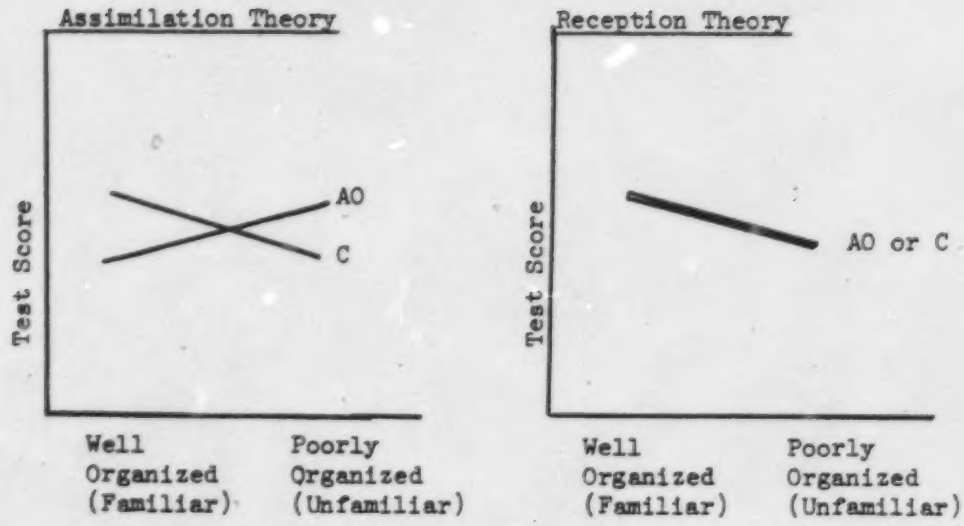
   (There was 1 other group)
3. NO. No means or statistics are given

Figure Captions

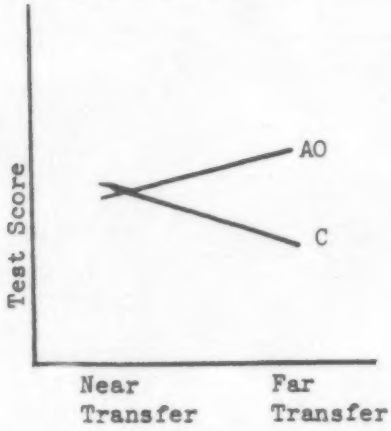
Fig. 1 Predictions of Assimilation and Reception Theories Concerning Materials x Treatment Interaction (MTI)

Fig. 2 Predictions of Assimilation and Reception Theories Concerning Knowledge x Treatment Interaction (KTI)

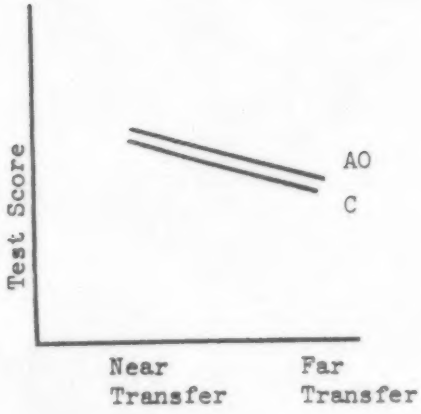
Fig. 3 Predictions of Assimilation, Addition and Reception Theories Concerning Treatment x Posttest Interaction (TPI)

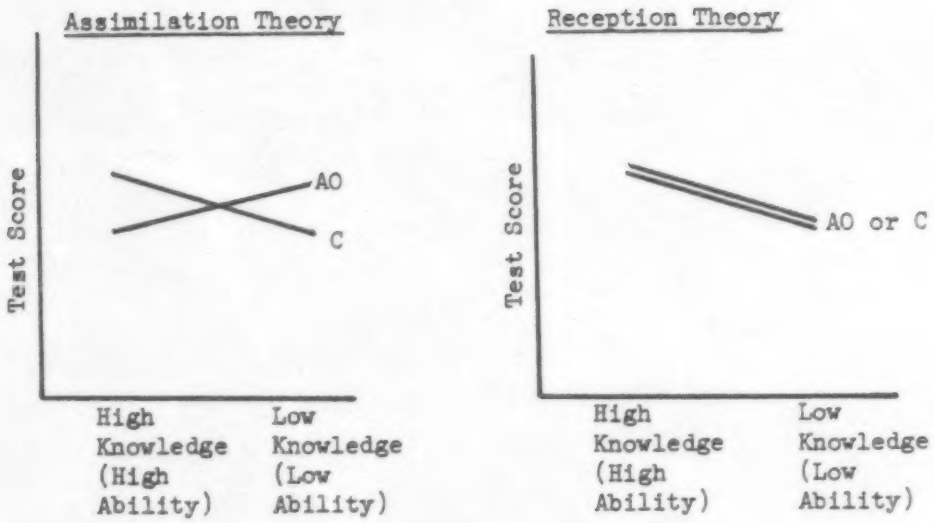

Assimilation Theory
Test Score
AO
C
Well Organized (Familiar)
Poorly Organized (Unfamiliar)
Reception Theory
Test Score
AO or C
Well Organized (Familiar)
Poorly Organized (Unfamiliar)

Assimilation Theory



Addition or Reception Theory




Assimilation Theory
Test Score
AO
C
High Knowledge (High Ability)
Low Knowledge (Low Ability)
Reception Theory
Test Score
AO or C
High Knowledge (High Ability)
Low Knowledge (Low Ability)

TECHNICAL REPORT SERIES IN LEARNING AND COGNITION

Report Number	Authors and Title
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